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(71)Applicant : MITSUBISHI MATERIALS CORP
(72)Inventor : ENDO TAKANORI
TSUCHIDA TAKASHI
HACHIMAN SEIRO

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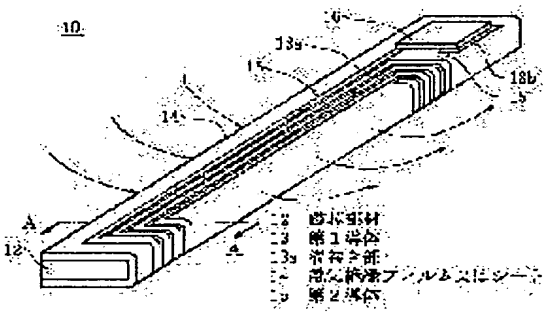
(54) ANTENNA COIL, IDENTIFICATION TAG USING THE SAME, READER- WRITER APPARATUS, READER AND WRITER

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an antenna coil which reliably operates, even when being closely contacted to a metal matter, and is formed into a very thin thickness.
SOLUTION: The antenna coil 11 has one or more spirals 13a of a series of first conductors 13 formed on one main surface of a foldable single electric insulation film or sheet 14 folded at the center of the spiral 13a, a film-like, foil-like, sheet-like or flat plane-like core member 12 is provided between the folded film or sheets 14. Both-end connection parts piecing the other main surface of the film or sheet 14 to mutually connect one end of the series of first conductors 13 and the other end are formed of a second conductor 15 on the other main surface of the film or sheet 14. The core member is preferably a magnetic paint film formed by applying ink or paint containing a magnetic powder to the main surface of the insulation film or sheet 14 and drying it.



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* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] 1 or the two or more whorl sections (13a) are formed in one principal plane of a bendable single electric insulation film or a sheet (14) with a series of 1st conductor (13). Antenna coil characterized by preparing the magnetic core member (12) by which said film or sheet (14) was bent in the center position of said whorl section (13a), and was formed between said bent film or the sheet (14) the shape of the shape of film, and a foil, the shape of a sheet, and plate-like.
[Claim 2] Antenna coil according to claim 1 by which the both-ends connection which penetrates a film or a sheet (14) and connects mutually one of a series of edges and other-end sections of the 1st conductor (13) was formed in the principal plane of another side of said film or a sheet (14) with the 2nd conductor (15).
[Claim 3] Antenna coil according to claim 2 which is the magnetic paint film (17) by which the magnetic core member (12) applied the ink or the coating containing magnetic powder to the principal plane of an electric insulation film or a sheet (14), and was formed in it by drying.
[Claim 4] Antenna coil according to claim 1 or 2 whose magnetic core member (12) is the plate of a soft magnetism metal, the powder which consists of amorphous or a ferrite or a flake and the composite of plastics, and a soft magnetism metal or a foil, an amorphous foil, its laminated wood, or a ferrite.
[Claim 5] etching the conductive foil pasted up on one whole principal plane of an electric insulation film or a sheet (14) by the predetermined pattern -- claim 1 by which the 1st conductor (13) was formed in one principal plane of said electric insulation film or a sheet (14) by screen-stenciling or vapor-depositing an electrical conducting material by the predetermined pattern to one principal plane of an electric insulation film or a sheet (14) thru/or 4 -- either -- the antenna coil of a publication. [or]
[Claim 6] claim 1 thru/or a claim -- the discernment tag equipped with IC chip (16) or the capacitor formed in the film or sheet (14) of the antenna coil (11) of a publication, and said antenna coil (11) 3 either by which the both ends of the 1st conductor (13) were connected to said IC chip (16) or capacitor.
[Claim 7] claim 1 thru/or a claim -- reader writer equipment equipped with the electronic circuitry connected to the antenna coil (11) of a publication, and said antenna coil (11) 3 either.
[Claim 8] claim 1 thru/or a claim -- reader equipment equipped with the electronic circuitry

connected to the antenna coil (11) of a publication, and said antenna coil (11) 3 either.
[Claim 9] claim 1 thru/or a claim -- writer equipment equipped with the electronic circuitry connected to the antenna coil (11) of a publication, and said antenna coil (11) 3 either.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the antenna coil used for the discernment tag which used the RFID (radio-frequency discernment: Radio Frequency Identification) technique or the EAS (electronic-formula goods monitor: Electronic Article Sureillannce) technique, reader writer equipment, reader equipment, and writer equipment and the discernment tag using it, reader writer equipment, reader equipment, and writer equipment.
[0002]
[Description of the Prior Art] Conventionally, the discernment tag which connected electrically to antenna coil the capacitor IC chip which memorized the information about goods, or for resonance as a tag using a RFID technique or an EAS technique is known. These discernment tags are attached in the flat-surface part of the goods identified or supervised. A tag is activated by sending the electric wave of a predetermined frequency to the antenna coil from the antenna coil for transmission and reception of reader writer equipment, reader equipment, or writer equipment. reading the information memorized by IC chip according to the read-out command by the data communication of an electric wave -- or it is constituted so that the goods may be identified or supervised by whether it resonates to the electric wave of a specific frequency.
[0003] As conventional antenna coil used for these discernment tags, reader writer equipment, reader equipment, or writer equipment What [was formed by a front face's winding around the curled form of an abbreviation square the lead wire covered with the insulating layer, and sticking on a base plate] Or the thing which the garbage was removed [thing] for conductive layers which carried out the laminating to the base plate 1 as shown in drawing 15 , such as aluminium foil and copper foil, by the etching method or the blanking method, and had the curled form whorl section 2 of an abbreviation square formed is known. Moreover, what has the magnetic core member 6 formed in tabular or cylindrical ** with the composite of the powder of a soft magnetism metal and plastics as another antenna coil as shown in drawing 14 , and the 1st conductor 7 spirally wound around this magnetic core member 6 is known.
[0004]
[Problem(s) to be Solved by the Invention] However, in the antenna coil shown in former drawing 15 , if magnetic flux arises in the direction which penetrates the base plate 1 up and down as the arrow head of drawing shows, and the antenna coil is stuck on metal goods, the electric wave sent toward antenna coil will penetrate the base plate 1, and will penetrate metal goods further. For this reason, the eddy current arose in the metal part by that magnetic flux to penetrate, and

there was a trouble that that eddy current affected it and the tag using antenna coil, reader writer equipment, reader equipment, or writer equipment stopped operating normally. Moreover, even if operated, there was fault to which the loss increases and the working distance of a tag, reader writer equipment, reader equipment, or writer equipment becomes remarkably short. Especially reader writer equipment, portable reader equipment, or portable writer equipment is small, and its lightweight thing is desirable. For that, considering as metal, such as comparatively strong aluminum, is appropriate for the case of reader writer equipment, reader equipment, or writer equipment. Moreover, when adding a RFID function to a device with the electronic circuitry for giving other functions, such as a cellular phone, interference of the electronic circuitry of RFID and other electronic circuitries can be lost by using a case as a metal. However, if the case in reader writer equipment, reader equipment, or writer equipment is used as a metal, the problem to which the effect of the eddy current produced in the case becomes comparatively large will arise.

[0005] On the other hand with the antenna coil shown in drawing 14 of the above-mentioned latter Also although the electric wave sent toward antenna coil does not penetrate metal goods and antenna coil operates normally even if it attaches this antenna coil in metal goods since it is generated in the direction of an axis of the magnetic core member 6 as magnetic flux shows by the arrow head of drawing In order to wind the 1st conductor 7 around the peripheral face of the magnetic core member 6, while the coil activity was comparatively complicated and lacked in mass-production nature, there was a trouble which the whole antenna coil becomes comparatively thick and projects comparatively greatly from goods. It is to offer the discernment tag using the antenna coil for tags and it which can form thickness very thinly while it operates certainly, even if it sticks the purpose of this invention on metal goods. It is to offer the antenna coil for reader writer equipment, reader equipment, and writer equipments which can form thickness very thinly while using it, sticking another purpose of this invention in a metal case. Still more nearly another purpose of this invention is to offer the antenna coil for the tag suitable for mass-production nature, reader writer equipment, reader equipment, and writer equipments, and the discernment tag using it.

[0006]

[Means for Solving the Problem] As invention concerning claim 1 is shown in drawing 1 and drawing 2 , 1 or two or more whorl sections 13a is formed in one principal plane of a bendable single electric insulation film or a sheet 14 with a series of 1st conductor 13. It is antenna coil characterized by for the film or the sheet 14 having whirled around, having been bent in the center position of section 13a, and forming the magnetic core member 12 formed in the shape of the shape of film, and a foil, the shape of a sheet, and plate-like between the bent film or a sheet 14. In the antenna coil indicated by this claim 1, the current which flows to whorl section 13a which was wound around the curled form, and which exists in both the principal planes of the magnetic core member 12 since the electric insulation film 14 is bent so that it may whirl and section 13a may divide into two, and that film 14 is pinching the magnetic core member 12 becomes hard flow mutually, and the direction of magnetic flux produced in the 1st conductor 13 becomes parallel to the direction of a field of the magnetic core member 12 formed in plate-like. For this reason, if this antenna coil 11 is attached in the front face of goods or a case, since that direction of magnetic flux will become the front face of goods or a case, and parallel, even if goods or a case is formed with the metal, the eddy current produced in goods or a case is controlled, and this antenna coil 11 operates certainly.

[0007] Moreover, if it whirls and two or more section 13a is prepared, the property of antenna coil can be raised by [by which it was wound around the curled form] being able to make the so-called count of winding increase easily, and making this count of winding increase. Moreover, since the 1st conductor 13 is formed in the electric insulation film 14 or a sheet, the handling becomes easy, the electric insulation film 14 or sheet can be bent, antenna coil 11 can be obtained by the easy activity pasted up on the magnetic core member 12, and mass-production nature can be raised as compared with the antenna coil shown in conventional drawing 12 which winds lead wire around the peripheral face of a magnetic core member, and manufactures the 1st conductor. Furthermore, since the magnetic core member 12 is formed in a foil, a sheet, or

plate-like, the thickness of antenna coil 11 can be formed very thinly. For this reason, it can project from the goods of the antenna coil 11 at the time of attaching in goods or a case, and an amount can be controlled remarkably.

[0008] Invention concerning claim 2 is invention concerning claim 1, and the both-ends connection which penetrates a film or a sheet 14 and connects mutually one of a series of edges and other-end sections of the 1st conductor 13 is antenna coil formed in the principal plane of another side of a film or a sheet 14 with the 2nd conductor 15. In the antenna coil concerning this claim 2, by forming the 2nd conductor 15 in the principal plane of another side of a film or a sheet 14, anchoring and connection of an electronic circuitry in IC chip required for a discernment tag, a capacitor or reader writer equipment, etc. become easy, and antenna coil excellent in mass-production nature can be obtained.

[0009] Invention concerning claim 3 is invention concerning claim 2, and as shown in drawing 8 , it is antenna coil which is the magnetic paint film 17 by which the magnetic core member 12 applied the ink or the coating containing magnetic powder to the principal plane of an electric insulation film or a sheet 14, and was formed in it by drying. In the antenna coil concerning this claim 3, shaping can obtain the magnetic core member 12 with a difficult thickness of 0.8mm or less in injection molding. Although it is desirable to form in the whole principal plane of an electric insulation film or a sheet 14 here as for the magnetic paint film 17, when the magnetic paint film 17 is missing from flexibility, it is desirable to carry out spreading formation of the magnetic paint film 17 only in one side bordering on the part which does not carry out spreading formation of the magnetic paint film 17 at the part by which an electric insulation film or a sheet 14 is bent or by which a principal plane is bent. Moreover, the magnetic paint film 17 may be formed in any of the principal plane of another side of the electric insulation film with which one principal plane of the electric insulation film with which the 1st conductor 13 was formed, or a sheet 14, or the 2nd conductor 15 was formed, or a sheet 14 as long as it constitutes and deals in the magnetic core member 12.

[0010] Invention concerning claim 4 is invention concerning claim 1 or 2, and as shown in drawing 1 , the magnetic core members 12 are a soft magnetism metal, and the plate of amorphous, the powder which consists of a ferrite or a flake and the composite of plastics, and a soft magnetism metal or a foil, an amorphous foil, its laminated wood or the antenna coil that is a ferrite. In the antenna coil concerning this claim 4, the magnetic core member 12 will become comparatively thin, and thickness of the antenna coil 11 whole can be made thin by making thin the magnetic core member 12 which occupies most thickness directions of antenna coil 11.

[0011] invention concerning claim 5 -- claim 1 thru/or 4 -- etching the conductive foil which is invention concerning either and was pasted up on one whole principal plane of an electric insulation film or a sheet 14 by the predetermined pattern -- or the 1st conductor 13 is antenna coil formed in one principal plane of an electric insulation film or a sheet 14 by screen-stenciling or vapor-depositing an electrical conducting material by the predetermined pattern to one principal plane of an electric insulation film or a sheet 14. In the antenna coil concerning this claim 5, it can become comparatively easy to form the 1st conductor 13 in an electric insulation film or a sheet 14, and the productivity of antenna coil can be raised further.

[0012] invention concerning claim 6 -- claim 1 thru/or a claim -- it is the discernment tag equipped with the IC chip 16 or capacitor formed in the film or sheet 14 of the antenna coil 11 of a publication, and antenna coil 11 3 either by which the both ends of the 1st conductor 13 were connected to the IC chip 16 or the capacitor. With the discernment tag concerning this claim 6, since the IC chip 16 or a capacitor is formed in the film or sheet 14 of antenna coil 11 formed very thinly, a discernment tag can be produced comparatively easily, it can project from the goods of the antenna coil 11 at the time of attaching in goods, and an amount can be controlled remarkably.

[0013] invention concerning claim 7 -- claim 1 thru/or a claim -- it is reader writer equipment equipped with the electronic circuitry connected to the antenna coil 11 and antenna coil 11 of a publication 3 either. invention concerning claim 8 -- claim 1 thru/or a claim -- it is reader equipment equipped with the electronic circuitry connected to the antenna coil 11 of a publication, and antenna coil 11 3 either. invention concerning claim 9 -- claim 1 thru/or a claim

-- it is writer equipment equipped with the electronic circuitry connected to the antenna coil 11 of a publication, and antenna coil 11 3 either. the reader writer equipment, reader equipment, or writer equipment concerning this claim 7 thru/or claim 9 -- claim 1 thru/or 3 -- by using the antenna coil concerning either, it can have a metal case, and since this antenna coil is very thin, the amount of protrusions from a case can lessen it. Consequently, overall thickness can obtain the tough and small reader writer equipment, reader equipment, or writer equipment which fitted mass-production nature very thinly.

[0014]

[Embodiment of the Invention] Next, the gestalt of operation of the 1st of this invention is explained based on a drawing. As shown in drawing 1 , the antenna coil 11 of this invention is equipped with the magnetic core member 12 formed in the shape of the shape of film, and a foil, the shape of a sheet, and plate-like, and the single electric insulation film or single sheet 14 by which 1 or two or more whorl sections 13a was formed in one principal plane with a series of 1st conductor 13. The magnetic core member 12 is formed by the plate or foil of a soft magnetism metal, or is formed in the shape of a rectangle with the composite of a soft magnetism metal, the powder which consists of amorphous or a ferrite or a flake, and plastics. Moreover, the magnetic core member 12 may be the ferrite which could be formed with amorphous foils, such as Fe system amorphous alloy (METGLAS 2605S-2 by the ARAIDO chemical company), and Co system amorphous alloy (METGLAS 2714A by the ARAIDO chemical company), or the laminated wood of those, and was formed in the shape of a rectangle.

[0015] Thermoplastic plastics with the sufficient workability as plastics in composite can be used, or thermosetting heat-resistant good plastics can be used. Moreover, as powder of the above-mentioned soft magnetism metal, atomization powder, such as a carbonyl-iron-powder and iron-permalloy, reduced iron powder, etc. are used. On the other hand, after making the above-mentioned powder detailed with a ball mill etc. and fabricating powder as a flake of a soft magnetism metal, the flake which flattened this powder mechanically and was obtained, and the flake which the molten metal grain of an iron system or a cobalt system amorphous alloy was made to collide with water-cooled copper, and was obtained are used. Moreover, when the magnetic core member 12 is formed with composite, the magnetic core member 12 can be formed for the composite injection molding or by pressing. Thus, as compared with the magnetic core member formed of the brittle ferrite, since it is tough, even if it makes thin the formed magnetic core member 12, it cannot break easily. Moreover, since plastics distributes and the powder or flake which consists of a ferrite is mutually insulated by plastics, even if it does not have conductivity as the whole but receives the electric wave of a RF, a soft magnetism metal, and amorphous or the magnetic core member 12 which does not generate an eddy current is obtained.

[0016] Here, the thickness is defined with the magnetic core member 12 by which the antenna coil 11 of this invention was formed in plate-like, and the electric insulation film or sheet 14 which has the 1st conductor 13. For this reason, in order to obtain thin antenna coil 11 as much as possible, as for the magnetic core member 12 which will occupy the greater part of that thickness direction, being formed thinly as much as possible is desirable. As for the magnetic core member 12, it is concretely desirable that the thickness is 0.1-1mm.

[0017] As shown in drawing 2 , the 1st conductor 13 is. It is formed in one principal plane of the bendable single electric insulation film 14 or a sheet. The film 14 or sheet of electric insulation which consists of polyethylene terephthalate (PET) or polyimide as the electric insulation film 14 or a sheet is used, and since it is bent behind and the magnetic core member 12 is pinched, this electric insulation film 14 or sheet is formed in the shape of [of the magnitude which put two magnetic core members 12 in order] a rectangle. formation of the 1st conductor 13 etches the conductive foil pasted up on one principal plane of an electric insulation film or a sheet 14 by the predetermined pattern -- or it can form by screen-stenciling or vapor-depositing an electrical conducting material by the predetermined pattern to one principal plane of an electric insulation film or a sheet 14. Moreover, the both-ends connection to which the antenna coil 11 for tags in the gestalt of this operation penetrates a film or a sheet 14, and connects mutually one of a series of edges and other-end sections of the 1st conductor 13 is formed in the principal plane

of another side of that film or a sheet 14 with the 2nd conductor 15.
[0018] Explanation of the procedure which forms the 1st and 2nd conductors 13 and 15 in a film 14 by etching prepares first what stuck copper foil on both the principal planes of this film 14. An etching-proof coating is printed by the silk screen method to this copper foil. Printing of the etching-proof coating in one principal plane of a film 14 is applied to a rectangle or a circular curled form from a core, spacing which ****s to the width of face of the IC chip 16 later mentioned to the outer edge is opened, and parallel parallel lines are applied. Printing of the etching-proof coating in the principal plane of another side of a film 14 is applied to the line which connects linearly the inner edge and parallel lines of the curled form printed matter applied to one principal plane. These etching-proof coatings are dried after that, etching removal of the copper foil in both the principal planes of the film 14 with which the etching-proof coating is not applied is carried out, and the copper foil part to which the etching-proof coating was applied is made to remain on one principal plane of a film. By removing an etching-proof coating from on the copper foil after that, terminal area 13b parallel to the 1st conductor 13 and its outer edge is formed in one principal plane of the film 14, and the 2nd conductor 15 is formed in the principal plane of another side of a film 14.
[0019] Since the etching-proof coating in one principal plane of a film 14 is applied to a rectangle or a circular curled form from a core here, the 1st conductor 13 formed in one principal plane of a film 14 will have whorl section 13a formed in the rectangle or the circular curled form from the core. Then, 1st through tube 14a (drawing 3) which is open for free passage at the end of the 2nd conductor 15 which penetrates a film 14, among those counters an edge is formed in the inner edge of whorl section 13a which is one edge of the 1st conductor 13, and 2nd through tube 14b (drawing 3) which penetrates a film 14 and is open for free passage to the other end of the 2nd conductor 15 is formed in terminal area 13b. The so-called SURUHORU plating is performed to the 1st and 2nd through tubes 14a and 14b after that, and the inner edge of whorl section 13a, the end of the 2nd conductor 15 and the other end of the 2nd conductor 15, and terminal area 13b are connected electrically. Thus, the physical relationship of the 1st and 2nd conductors 13 and 15 formed in the film 14 is shown in drawing 3 . According to this etching, the electric insulation film 14 or electric insulation sheet with which the 1st and 2nd conductors 13 and 15 were formed can be manufactured comparatively cheaply.
[0020] Moreover, with the gestalt of this operation, the case where the discernment tag 10 is manufactured using antenna coil 11 is shown, and the IC chip 16 required for that discernment tag 10 is formed in a film 14. This IC chip 16 is carried in one principal plane of a film 14 so that the 1st conductor 13 and terminal area 13b which were formed in one principal plane of a film 14 may be constructed. It is soldered to the 1st conductor 13 and terminal area 13b in the condition, direct continuation of the IC chip 16 is carried out to the other-end section of the 1st conductor 13 which is the outer edge of coil section 13a, and one edge of the 1st conductor 13 which is the inner edge of coil section 13a is connected to the IC chip 16 through the 2nd conductor 15.
[0021] Thus, the electric insulation film 14 with which the 1st conductor 13 was formed is bent so that whorl section 13a wound around the curled form may be bisected. Bending of the electric insulation film 14 in the gestalt of this operation is bent in the central part shown with the alternate long and short dash line of drawing 2 so that the 1st conductor 13 may become outside. As the magnetic core member 12 of the electric insulation film 14 bent as shown in drawing 1 is pinched, it pastes it up on the magnetic core member 12. As the adhesion to the magnetic core member 12 of the electric insulation film 14 applies adhesives to either or the both sides of the magnetic core member 12 and the electric insulation film 14, bends the electric insulation film 14 after that and its magnetic core member 12 is pinched, it pastes it up on the magnetic core member 12.
[0022] Thus, since the discernment tag 10 which the using RFID technique since the thickness of constituted antenna coil 11 was very thin and IC chip 16 was electrically connected to 1st conductor 13 discernment tag 10 was manufactured, and was manufactured in this way is also very thin, as it is shown in drawing 4 , even if it attaches in goods 18, antenna coil 11 hardly projects from goods 18. Moreover, it becomes parallel to the direction of the field of the

magnetic core member 12 by which the current which flows to whorl [which was wound around the curled form] section which exists in both [of the magnetic core member 12] principal planes since electric insulation film 14 is bent so that it may whirl and section 13a may divide into two, and the film 14 is pinching magnetic core member 12 13a became hard flow mutually, and the direction of the magnetic flux of the 1st conductor 13 was formed in plate-like. For this reason, if this antenna coil 11 is attached on the surface of goods, since that direction of magnetic flux will become the front face of the goods 18 as shown by the arrow head of drawing 4 , and parallel, even if goods 18 are formed with the metal, the eddy current produced on goods 18 is controlled, and the resonance frequency of antenna coil 11 is not influenced of the above-mentioned metal goods, but this antenna coil 11 operates certainly. However, in order to prevent that whorl section 13a contacts the metal, and flows, it is necessary to make the insulating film 19 infix between the whorl section 13a and goods 18, as shown in drawing 5 when the front face of goods 18 is formed with the metal. Furthermore, electric conduction plates, such as a little larger aluminum plate than antenna coil, are arranged into the part which touches the goods of antenna coil, and if the area and the number of turns of a coil are selected so that it may become a desired inductance in the condition, the effect of goods will decrease.

[0023] Moreover, since the 1st conductor 13 is formed in the electric insulation film 14 or a sheet in this antenna coil 11, that handling becomes easy, that electric insulation film 14 or sheet can be bent, antenna coil 11 can be obtained by the easy activity pasted up on the magnetic core member 12, and mass-production nature can be raised as compared with the conventional antenna coil which winds lead wire around the peripheral face of a magnetic core member, and manufactures the 1st conductor. Moreover, since the antenna coil 11 for tags is equipped with the electric insulation film 14 or a sheet By becoming possible to paste up the required IC chip 16 on this electric insulation film 14 or sheet, when using it as a tag, and pasting up the IC chip 16 beforehand like the gestalt of this operation It can become possible to obtain a desired tag in the phase which pasted up the bent electric insulation film 14 or the bent sheet on the magnetic core member 12, and the mass-production nature can be raised further.

[0024] In addition, although the gestalt of operation mentioned above explained the plate of a soft magnetism metal, composite, and a soft magnetism metal or a foil, an amorphous foil, its laminated wood, or the magnetic core member 12 that consists of a ferrite, although the magnetic core member 12 is not illustrated, it may be equipped with the magnetic paint film formed in the front face of an insulating resin film or a sheet, and a this insulating resin film or a sheet. It is made from this magnetic core member by carrying out spreading desiccation of the coating containing the powder or flake which becomes the front face of an insulating resin film or a sheet from a magnetic material, and in injection molding, shaping can obtain the magnetic core member 12 with a difficult thickness of 0.8mm or less, and can obtain still thinner antenna coil 11.

[0025] Moreover, with the gestalt of operation mentioned above, the electric insulation film 14 was bent so that the 1st conductor 13 might become outside, but the electric insulation film 14 may be bent so that the 1st conductor 13 may become inside, as shown in drawing 7 . However, when it is the case where the 1st conductor 13 becomes inside and the magnetic core member 12 is conductivity, it is inserted after covering the front face of the magnetic core member 12 with an insulating material. Furthermore, although the gestalt of operation mentioned above explained the plate of a soft magnetism metal, composite, and a soft magnetism metal or a foil, an amorphous foil, its laminated wood, or the magnetic core member 12 that consists of a ferrite, the magnetic core member 12 may be formed by the magnetic paint film. In this case, as shown in drawing 6 , the antenna coil shown in the electric insulation film or the sheet 14 in which the 1st conductor 13 was formed at drawing 7 , according to the simple activity which bends that electric insulation film or sheet 14 if direct spreading formation of the magnetic paint film 17 is carried out can be obtained comparatively easily.

[0026] Next, the gestalt of operation of the 2nd of this invention is shown in drawing 8 - drawing 10 . The same sign as the gestalt of operation mentioned above among the drawing shows the same components, and omits the explanation to repeat. As shown in drawing 10 , the 1st conductor 13 in the gestalt of this operation has two or more whorl sections 13a and 13a wound

around the curled form, and two or more of these whorl sections 13a and 13a open predetermined spacing, and are prepared in the single electric insulation film 14. The 1st conductor 13 which shows the example which was wound around two curled forms by a diagram, and in which it whirls and Sections 13a and 13a are formed in the electric insulation film 14, and has the two whorl sections 13a and 13a is formed in the front face of the electric insulation film 14 by screen-stenciling or vapor-depositing electrical conducting materials, such as Cu, aluminum, and Zn, by the predetermined pattern. By printing or vapor-depositing and forming the 1st conductor 13 in the front face of the electric insulation film 14, it becomes possible to perform comparatively many production comparatively cheaply. When the 2nd conductor 15 (drawing 10) screen-stencils or vapor-deposits, it is formed in the rear face of the electric insulation film 14, and the IC chip 16 is electrically connected to the 1st two continuous conductor 13 which whirls around and has Sections 13a and 13a through the 2nd conductor 15, where the electric insulation film 14 is pasted.

[0027] As shown in drawing 9 , spreading desiccation of the coating which contains the powder or flake which consists of a magnetic material in the rear face of the electric insulation film 14 is carried out, and the magnetic paint film 17 is formed in the rear face of the insulating resin film 14. As powder of the magnetic material included in a coating here, atomization powder, such as a carbonyl-iron-powder and iron-permalloy, reduced iron powder, etc. are used. On the other hand, after making the above-mentioned powder detailed with a ball mill etc. and fabricating powder as a flake of a magnetic material, the flake which flattened this powder mechanically and was obtained, and the flake which the molten metal grain of an iron system or a cobalt system amorphous alloy was made to collide with water-cooled copper, and was obtained are used.

[0028] It is desirable still more desirable that it is 10-100 micrometers, and the thickness of the insulating resin film 14 at the time of forming the magnetic paint film 17 here or a sheet is 20-40 micrometers. Moreover, 10-800 micrometers is desirable still more desirable, and the thickness of the formed magnetic paint film 17 is 30-300 micrometers. In addition, when predetermined thickness is not obtained only by applying a coating once, the paint film 17 of desired thickness can be obtained by carrying out spreading desiccation of the same coating repeatedly. This magnetic paint film 17 plays a role of a magnetic core member 12 behind, and it enables shaping to obtain comparatively cheaply the magnetic core member 12 with a difficult thickness of 0.8mm or less in injection molding. Moreover, since the magnetic paint film 17 is formed by carrying out spreading desiccation of the coating, when the flake which becomes the coating from a magnetic material is included, it also becomes possible by arranging the flake in parallel with the front face of the insulating resin film 14 or a sheet to raise the property of the magnetic core member 12.

[0029] Then, as the arrow head of drawing 9 shows, the electric insulation film 14 is bent so that it may be divided into two at the core of two or more whorl sections 13a and 13a, respectively, but it is bent so that the magnetic paint film 17 may become inside in that case. Towards intersecting perpendicularly in the direction in which two or more 1st conductors 13 and 13 continue, this electric insulation film 14 is bent in the same direction, respectively, and is pasted up. As shown in drawing 8 , with the gestalt of this operation, by bending the electric insulation film 14 twice, the magnetic paint film 17 is wrapped in with the electric insulation film 14, and the antenna coil which has the magnetic core member 12 which consists of a magnetic paint film is obtained.

[0030] Thus, since the constituted antenna coil 11 has the magnetic core member which consists of a magnetic paint film, it can make the thickness still thinner, and since it formed two or more 1st conductors 13 and 13, it can raise the property of antenna coil further. For this reason, the antenna coil 11 with which the direction of magnetic flux is parallel to a goods front face with antenna coil, and hardly projects from goods can be obtained. Moreover, since the magnetic core member 12 becomes the electric insulation film 14 or a sheet from the magnetic paint film 17 by which spreading formation was carried out beforehand, the handling becomes still easier, the electric insulation film 14 or a sheet can be bent, antenna coil 11 can be obtained by the very easy activity [only pasting the magnetic core member 12], and the mass-production nature of antenna coil 11 can be raised further.

[0031] in addition, although the case where had the two whorl sections 13a and 13a which were

mentioned above and by which the 1st conductor 13 was wound around the curled form with the gestalt of the 2nd operation, and the electric insulation film 14 was bent twice was explained, the 1st conductor 13 was wound around the curled form -- whirling -- the 13a3 sections, four, five, and six -- or you may have seven or more. If it whirls and the number of the sections is made to increase, the property of antenna coil can be raised by [to which it was wound around the curled form] the so-called count of winding increasing and making this count of winding increase. However, since the whorl section of these plurality needs to be bisected, respectively, an electric insulation film or a sheet needs to bend only the number which ****s in the number of the whorl sections. The case where the 1st conductor 13 has the four whorl sections 13a and 13a is shown in drawing 11 . in this drawing 11 , an electric insulation film or a sheet 14 ****s in the number of those whorl sections -- it is bent 4 times, and as long as four whorl sections 13a is bisected, respectively and exists in both the principal planes of the magnetic core member 12, the direction of magnetic flux of the 1st conductor 13 can become parallel to the direction of a field of the magnetic core member 12, and can raise the property of antenna coil in proportion to the number of whorl section 13a.

[0032] Moreover, although the gestalt of the 1st and 2nd operations mentioned above showed the case where the discernment tag 10 was manufactured using antenna coil 11, respectively, the antenna coil of this invention may be used for reader writer equipment, reader equipment, or writer equipment. In this case, since the thickness of antenna coil 11 is very thin, even if it attaches this antenna coil 11 in the case of reader writer equipment, reader equipment, or writer equipment, antenna coil 11 hardly projects from a case. Moreover, since the direction of magnetic flux becomes parallel to the direction of a field of the magnetic core member 12 formed in plate-like, even if that direction of magnetic flux becomes the front face of a case, and parallel and the case is formed with the metal, the eddy current produced in a case is controlled, and the resonance frequency of antenna coil 11 is not influenced of the above-mentioned metal case, but this antenna coil 11 operates certainly.

[0033]

[Example] Next, the example of this invention is explained in detail with the example of a comparison.

As shown in <example 1 of comparison> drawing 2 , the 1st conductor 13 was formed in the single electric insulation film. The polyimide film with a thickness of 50 micrometers was used as an electric insulation film. By etching into this polyimide film copper foil with a thickness of 35 micrometers by which laminating adhesion was carried out, the 1st conductor 13 formed the 1st conductor 13, and an appearance is 16mmx50mm, this 1st conductor 13 made the whorl section whose width of face is 0.8mm wind 4 times, and it formed it. The antenna coil which consists only of the 1st conductor 13 prepared in this electric insulation film was made into the example 1 of a comparison.

[0034] The 1st same conductor 13 as the example 1 of a comparison was formed in the same electric insulation film as the example 1 of a <example 1> comparison with the same procedure as the example 1 of a comparison. Moreover, thickness was 50 micrometers independently, and the appearance prepared two polyimide films which are 8mmx50mm, made one side of these polyimide films carry out spreading desiccation of the ink containing a magnetic flake, respectively, and formed the magnetic paint film with a thickness of 130 micrometers in those one side, respectively. And the polyimide film of two sheets with which the magnetic paint film was formed was piled up. On the other hand, the electric insulation film was bent so that the 1st conductor might be bisected, and the antenna coil which inserts the polyimide film of two sheets with which the magnetic paint film was formed between them, and is shown in drawing 1 was obtained. Thus, on both sides of the magnetic core member which consists of a magnetic paint film, antenna coil was made into the example 1 with the electric insulation film. In addition, the aluminum plate with the thickness of 0.1mm, a width of face [of 10mm], and a die length of 60mm has been arranged into the part which touches goods.

[0035] The electric insulation film 14 which consists of a polyimide film whose <example 2> thickness is 35 micrometers, and whose appearance is 49mmx50mm was prepared, and as shown in drawing 12 , the 1st conductor 13 which has the two rectangle-like whorl sections 13a and

13a was formed by etching into this polyimide film copper foil with a thickness of 35 micrometers by which laminating adhesion was carried out. the conductor width in the direction in which the appearance of the 1st conductor 13 which consists of these two whorl sections 13a and 13a is 48mmx48mm, and the conductor width in a longitudinal direction is 3mm, and intersects perpendicularly with it -- 2mm -- becoming -- making -- the two whorl sections 13a and 13a -- a conductor -- it was made to wind twice, respectively and formed so that spacing of a between might be set to 1mm.

[0036] Moreover, thickness was 50 micrometers independently, and the appearance prepared four polyimide films which are 24mmx50mm, made one side of these polyimide films carry out spreading desiccation of the ink containing a magnetic flake, respectively, and formed the magnetic paint film with a thickness of 160 micrometers in those one side, respectively. And the polyimide film of four sheets with which the magnetic paint film was formed was piled up, and it considered as the magnetic core member 12. On the other hand, as the alternate long and short dash line of drawing 12 showed, the electric insulation film 14 was bent so that it might be divided into two at the core of two or more whorl sections 13a and 13a, respectively, and antenna coil was obtained by wrapping the magnetic core member 12 in the electric insulation film 14, as shown in drawing 13 . This antenna coil was made into the example 2. In addition, the polyimide film with a thickness of 50 micrometers has been arranged into the part which touches goods.

[0037] The acrylic board whose thickness it is 100mmx100mm and is 0.16mm as <comparative study> goods, and the acrylic board and aluminum plate of isomorphism Doshisha University, and a mild steel plate were prepared, respectively. The antenna coil in the example 1 of a comparison, the example 1, and example 2 which were mentioned above on the front face of these acrylic boards, an aluminum plate, and a mild steel plate has been arranged, respectively. Q value was measured, respectively in L value list of the 1st conductor to the predetermined frequency in this case. Moreover, the tag which connects IC chip to the antenna coil of the example 1 of a comparison, an example 1, and an example 2, respectively, and operates by 13.56MHz was obtained. The existence of actuation in the case of having arranged, respectively on the front face of the acrylic board which mentioned this tag above, an aluminum plate, and a mild steel plate was checked. These results are shown in Table 1, respectively.

[0038]

[Table 1]

	物品	アクリル板		アルミ板		軟鋼板	
	所定の周波数 (MHz)	L (μH)	Q	L (μH)	Q	L (μH)	Q
比較例1	1	1.257	7.1	0.538	2.5	1.002	2.0
	5	1.222	26.1	0.448	8.9	0.660	3.3
	10	1.231	42.7	0.440	14.5	0.583	4.1
	12	1.240	48.0	0.440	16.5	0.568	4.3
	13.56	1.245	51.9	0.440	17.9	0.561	4.5
	15	1.256	53.9	0.440	18.9	0.554	4.6
	20	1.293	61.0	0.443	22.2	0.541	5.1
	動作の有無	作動		非作動		非作動	
実施例1	1	0.958	4.7	0.917	4.5	0.969	4.4
	5	0.906	16.6	0.862	15.4	0.896	13.3
	10	0.909	25.0	0.866	23.0	0.897	19.1
	12	0.915	25.7	0.875	24.4	0.904	20.2
	13.56	0.921	27.0	0.882	24.8	0.911	20.5
	15	0.927	26.1	0.890	24.0	0.919	19.9
	20	0.951	21.0	0.923	19.4	0.951	16.7
	動作の有無	作動		作動		作動	
実施例2	1	0.875	8.2	0.543	6.5	0.573	6.4
	5	0.804	28.9	0.510	22.4	0.528	19.3
	10	0.806	43.5	0.512	33.4	0.528	27.7
	12	0.811	44.8	0.517	35.4	0.532	29.3
	13.56	0.816	47.0	0.520	36.0	0.536	29.8
	15	0.821	45.5	0.526	34.8	0.541	28.9
	20	0.842	36.6	0.545	28.2	0.560	24.4
	動作の有無	作動		作動		作動	

[0039] In an example 1 and the example 2, L value hardly changes either on an acrylic board, an aluminum plate, and a mild steel plate, but, also in on an aluminum plate and a mild steel plate, it is few to the fall of Q value as compared with the case of an acrylic board so that clearly from Table 1. However, in the example 1 of a comparison, L value changes remarkably on an aluminum plate as compared with an acrylic board top. Moreover, as for the case on a mild steel plate, Q value falls remarkably. Since this has the direction parallel to the field of a plate of the magnetic flux generated from a coil in the example 1 and is covered with the electric conduction plate, although it does not reach on the surface of a plate, in the example of a comparison, it is because the direction of magnetic flux is perpendicular to the field of a plate and the great portion of magnetic flux reaches a plate. Moreover, to operating, even if it arranges the tag which connected IC chip to the antenna coil of an example 1 and an example 2 on which front face of an acrylic board, an aluminum plate, and a mild steel plate, the tag which connected IC chip to the antenna coil of the example 1 of a comparison operated, only when it had arranged on the surface of an acrylic board, and when it had arranged on the front face of an aluminum plate and a mild steel plate, it did not operate. This is considered that L value changed in the case of the aluminum plate, and resonance frequency changed because energy was absorbed by the griddle and lost.

[0040]

[Effect of the Invention] As stated above, since the electric insulation film or sheet is pasted up on a magnetic core member on both sides of a magnetic core member with the electric insulation film or sheet which prepared the 1st conductor in a single electric insulation film or a single sheet, and was wound around the curled form and which whirled around, bent the electric insulation film or the sheet at the core of the section, and was bent, according to this invention, the thickness of antenna coil can be formed very thinly. Moreover, if this antenna coil is attached in the front face of goods or a case, since that direction of magnetic flux will become a goods front face and parallel, even if goods or a case is formed with the metal, the eddy current produced in goods or a case is controlled, the resonance frequency of antenna coil cannot be influenced of the above-mentioned metal goods or a case, but can obtain the antenna coil which operates certainly, and can control protrusion **** from the goods of the discernment tag using it.

[0041] Moreover, open predetermined spacing and the whorl section wound around two or more curled forms is prepared in a single electric insulation film or a single sheet. If a magnetic core member is wrapped in the electric insulation film or sheet which bent the electric insulation film or the sheet in the multiple-times same direction, and was bent two or more times at the core of those whorl sections and it pastes up with it The antenna coil which raised the property further can be obtained by being able to make the so-called count of winding increase easily, and making this count of winding increase.
[0042] furthermore, the 1st conductor -- etching -- or if it forms by screen-stenciling or vapor-depositing, formation of the 1st conductor to an electric insulation film or a sheet will become comparatively easy. On the other hand, if a magnetic core member is the plate of a soft magnetism metal, the powder which consists of amorphous or a ferrite or a flake and the composite of plastics, and a soft magnetism metal or a foil, an amorphous foil, its laminated wood, or a ferrite, it becomes what has a comparatively thin magnetic core member, and thickness of the whole antenna coil can be made thin. By using as a magnetic core member the magnetic paint film formed especially in an electric insulation film or a sheet, a magnetic core member can be made still thinner and it enables shaping to obtain still thinner antenna coil by the magnetic core member with a difficult thickness of 0.8mm or less in injection molding.

[Translation done.]

* NOTICES *

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3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The perspective view of a discernment tag which has antenna coil of the 1st operation gestalt of this invention.
[Drawing 2] The top view showing the 1st conductor formed in the electric insulation film or the sheet.
[Drawing 3] The decomposition perspective view showing the relation of the film or sheet, and 1st and 2nd conductors.
[Drawing 4] The A-A line sectional view of drawing 1 showing the condition that the discernment tag was attached in goods.
[Drawing 5] The sectional view corresponding to drawing 4 by which the insulating film was infixed between the whorl section and goods.
[Drawing 6] Drawing of longitudinal section showing the electric insulation film or sheet with which the magnetic paint film was formed upwards the 1st conductor.
[Drawing 7] Drawing of longitudinal section showing the antenna coil with which the electric insulation film or sheet was bent and obtained.
[Drawing 8] The sectional view corresponding to drawing 4 which shows the antenna coil of the 2nd operation gestalt of this invention.
[Drawing 9] The B-B line sectional view of drawing 10 which shows the condition that the magnetic paint film was formed to the electric insulation film or sheet.
[Drawing 10] The top view corresponding to drawing 2 which shows the 1st conductor in the

antenna coil.
[Drawing 11] The sectional view corresponding to drawing 8 which shows the antenna coil with which the 1st conductor has the four whorl sections.
[Drawing 12] The top view showing the 1st conductor which consists of the two whorl sections in the 2nd example.
[Drawing 13] The perspective view of antenna coil which has the 1st conductor.
[Drawing 14] The perspective view showing the conventional antenna coil which has the 1st conductor spirally wound around the magnetic core member.
[Drawing 15] The perspective view showing the conventional antenna coil which consists of the curled form whorl section.
[Description of Notations]
11 Antenna Coil for Tags
12 Magnetic Core Member
13 1st Conductor
13a Whorl section
14 Electric Insulation Film or Sheet
15 2nd Conductor
17 Magnetic Paint Film

[Translation done.]

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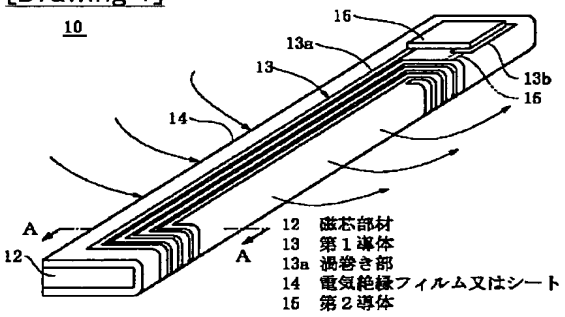
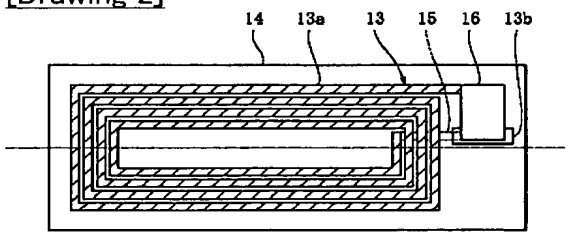
DRAWINGS

[Drawing 1]



[Drawing 2]



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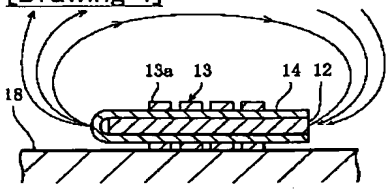
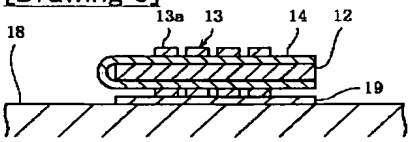


[Drawing 5]



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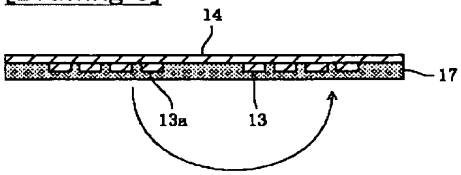
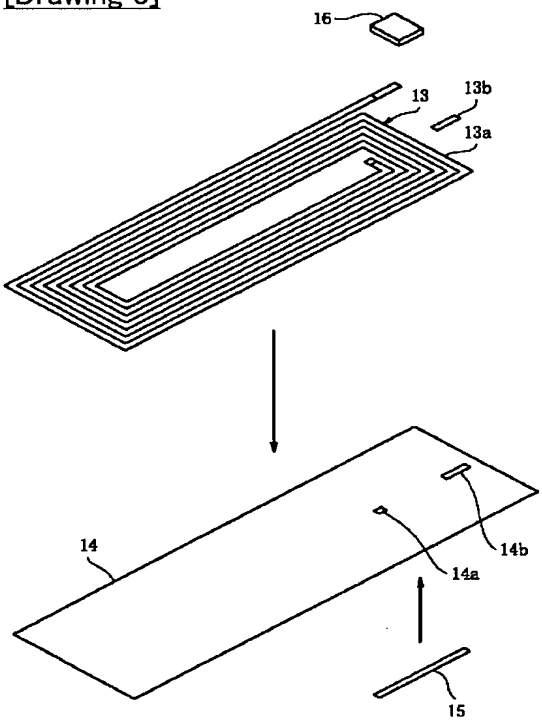
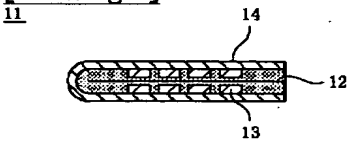


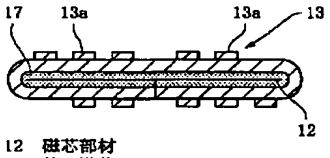
[Drawing 3]



[Drawing 7]

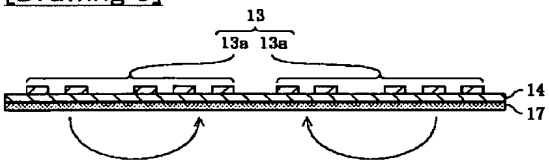


[Drawing 8]

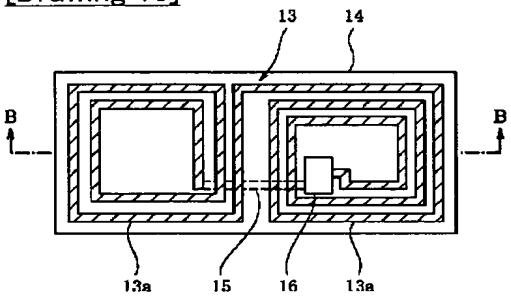


12 磁芯部材
13 第１導体
13a 渦巻き部
14 電気絶縁フィルム又はシート
17 磁性塗膜

[Drawing 9]

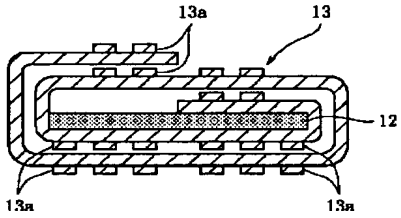


[Drawing 10]

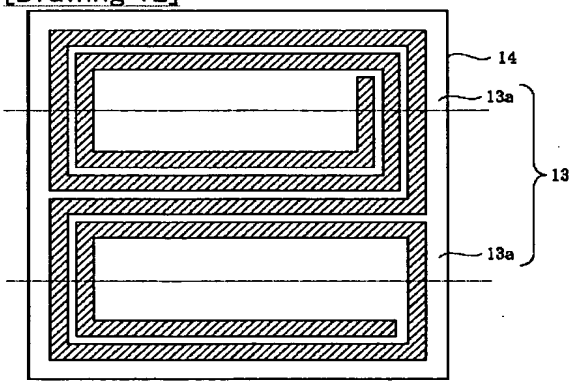


[Drawing 11]

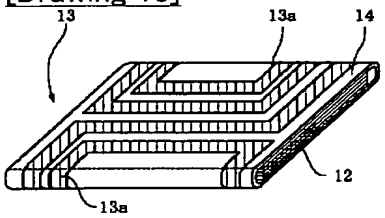
11



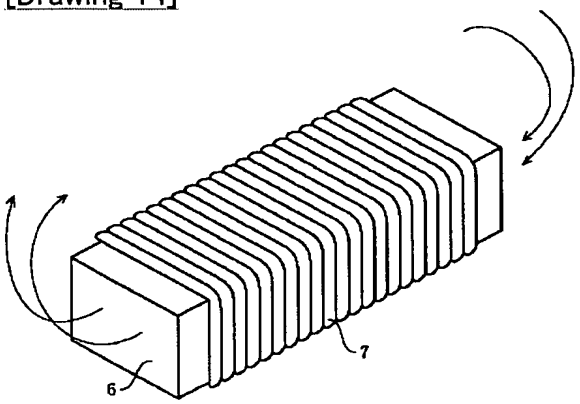
[Drawing 12]



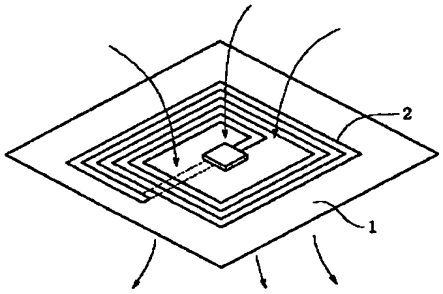
[Drawing 13]



[Drawing 14]



<EMI ID=000017 HE=055 WI=071 LX=0910 LY=2160> [Drawing 15]



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			Ｅ　５Ｂ０３５
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Ｇ０６Ｋ　17/00		Ｇ０６Ｋ　17/00	Ｆ　５Ｅ０７０
19/07		19/00	Ｈ

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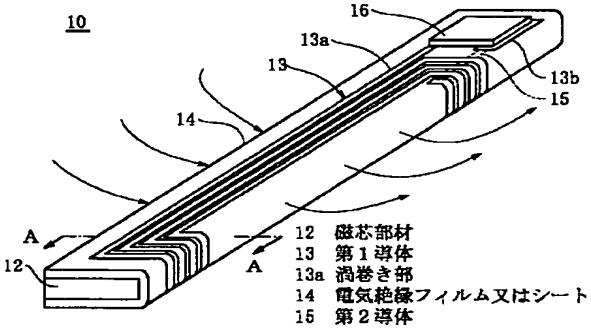
(71)出願人　000006264
三菱マテリアル株式会社
東京都千代田区大手町１丁目５番１号
(72)発明者　遠藤　貴則
東京都文京区小石川１丁目12番14号　三菱マテリアル株式会社ＲＦ－ＩＤ事業センター内
(74)代理人　100085372
弁理士　須田　正義

最終頁に続く

(54)【発明の名称】　アンテナコイル及びそれを用いた識別タグ、リーダライタ装置、リーダ装置及びライタ装置

(57)【要約】
【課題】　金属製の物品に密着させても確実に作動するとともに、アンテナコイルの厚さを極めて薄く形成する。
【解決手段】　アンテナコイル１１は、折り曲げ可能な単一の電気絶縁フィルム又はシート１４の一方の主面に一連の第１導体１３により１又は２以上の渦巻き部１３ａが形成され、フィルム又はシート１４が渦巻き部１３ａの中心位置で折り曲げられ、折り曲げられたフィルム又はシート１４の間に膜状、箔状、シート状又は平板状に形成された磁芯部材１２が設けられる。一連の第１導体１３の一方の端部と他方の端部とをフィルム又はシート１４を貫通して互いに接続する両端接続部がフィルム又はシート１４の他方の主面に第２導体１５により形成される。磁芯部材は、電気絶縁フィルム又はシート１４の主面に磁性粉を含むインク又は塗料を塗布し乾燥して形成された磁性塗膜であることが好ましい。



【特許請求の範囲】
【請求項１】　折り曲げ可能な単一の電気絶縁フィルム又はシート(14)の一方の主面に一連の第１導体(13)により１又は２以上の渦巻き部(13a)が形成され、
前記フィルム又はシート(14)が前記渦巻き部(13a)の中心位置で折り曲げられ、
前記折り曲げられたフィルム又はシート(14)の間に膜状、箔状、シート状又は平板状に形成された磁芯部材(12)が設けられたことを特徴とするアンテナコイル。
【請求項２】　一連の第１導体(13)の一方の端部と他方の端部とをフィルム又はシート(14)を貫通して互いに接続する両端接続部が前記フィルム又はシート(14)の他方の主面に第２導体(15)により形成された請求項１記載のアンテナコイル。
【請求項３】　磁芯部材(12)が電気絶縁フィルム又はシート(14)の主面に磁性粉を含むインク又は塗料を塗布し乾燥して形成された磁性塗膜(17)である請求項２記載のアンテナコイル。
【請求項４】　磁芯部材(12)が、軟磁性金属，アモルファス又はフェライトからなる粉末又はフレーク及びプラスチックの複合材、軟磁性金属の板又は箔、アモルファス箔又はその積層材、或いはフェライトである請求項１または２記載のアンテナコイル。
【請求項５】　電気絶縁フィルム若しくはシート(14)の一方の主面全体に接着された導電性箔を所定のパターンでエッチングすることにより、又は電気絶縁フィルム若しくはシート(14)の一方の主面に導電材料を所定のパターンでスクリーン印刷若しくは蒸着することにより、第１導体(13)が前記電気絶縁フィルム又はシート(14)の一方の主面に形成された請求項１ないし４いずれか記載のアンテナコイル。
【請求項６】　請求項１ないし請求項３いずれか記載のアンテナコイル(11)と、前記アンテナコイル(11)のフィルム又はシート(14)に設けられたＩＣチップ(16)又はコンデンサとを備え、第１導体(13)の両端が前記ＩＣチップ(16)又はコンデンサに接続された識別タグ。
【請求項７】　請求項１ないし請求項３いずれか記載のアンテナコイル(11)と、前記アンテナコイル(11)に接続された電子回路とを備えたリーダライタ装置。
【請求項８】　請求項１ないし請求項３いずれか記載のアンテナコイル(11)と、前記アンテナコイル(11)に接続された電子回路とを備えたリーダ装置。
【請求項９】　請求項１ないし請求項３いずれか記載のアンテナコイル(11)と、前記アンテナコイル(11)に接続された電子回路とを備えたライタ装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、ＲＦＩＤ（無線周波数識別：Radio Frequency Identification）技術又はＥＡＳ（電子式物品監視：Electronic Article Surveillance）技術を用いた識別タグ、リーダライタ装置、リーダ装置及びライタ装置に用いられるアンテナコイル、及びそれを用いた識別タグ、リーダライタ装置、リーダ装置及びライタ装置に関するものである。
【０００２】
【従来の技術】従来、ＲＦＩＤ技術又はＥＡＳ技術を用いたタグとして、アンテナコイルに物品に関する情報を記憶したＩＣチップ又は共振用のコンデンサを電気的に接続した識別タグが知られている。これらの識別タグは識別又は監視される物品の平面部分に取付けられ、そのアンテナコイルにリーダライタ装置、リーダ装置又はライタ装置の送受信用のアンテナコイルから所定の周波数の電波を発信することによりタグを活性化し、電波のデータ通信による読出しコマンドに応じてＩＣチップに記憶された情報を読みとることにより、又は特定周波数の電波に対して共振するか否かによりその物品を識別又は監視するように構成される。
【０００３】これらの識別タグ、リーダライタ装置、リーダ装置又はライタ装置に用いられる従来のアンテナコイルとして、表面が絶縁層にて被覆された導線を略正方形の渦巻き状に巻回してベース板に貼付けることにより形成されたものや、或いは図１５に示すようにベース板１に積層したアルミニウム箔や銅箔等の導電層をエッチング法又は打抜き法等により不要部分を除去して略正方形の渦巻き状の渦巻き部２を形成されたものが知られている。また、別のアンテナコイルとして、図１４に示すように軟磁性金属の粉末とプラスチックとの複合材により板状又は円柱状等に形成された磁芯部材６と、この磁芯部材６に螺旋状に巻回された第１導体７とを有するものが知られている。
【０００４】
【発明が解決しようとする課題】しかし、前者の図１５に示すアンテナコイルでは磁束が図の矢印で示すようにベース板１を上下に貫通する方向に生じ、そのアンテナコイルを金属製の物品に密着させると、アンテナコイルに向って発信された電波がそのベース板１を貫通し更に金属製物品を貫通する。このため、その貫通する磁束により金属部分に渦電流が生じ、その渦電流が影響を与えてアンテナコイルを用いたタグ、リーダライタ装置、リーダ装置又はライタ装置が正常に作動しなくなる問題点があった。また、仮に作動したとしてもその損失が増してタグ、リーダライタ装置、リーダ装置又はライタ装置の作動距離が著しく短くなる不具合があった。特に、携帯用のリーダライタ装置、リーダ装置又はライタ装置は、小型であってかつ軽量であることが好ましい。このためにはリーダライタ装置、リーダ装置又はライタ装置のケースは比較的強硬なアルミ等の金属製とすることが適当である。また携帯電話等の他の機能を持たせるための電子回路を持つ機器にＲＦＩＤ機能を追加する場合は、ケースを金属とすることによりＲＦＩＤの電子回路

と他の電子回路の干渉をなくすことができる。しかしリーダライタ装置、リーダ装置又はライタ装置等におけるケースを金属とすると、そのケースに生じる渦電流の影響が比較的大きくなる問題が生じる。

【０００５】一方、上記後者の図１４に示すアンテナコイルでは、磁束が図の矢印で示すように磁芯部材６の軸芯方向に生じるので、このアンテナコイルを金属製の物品に取付けても、アンテナコイルに向って発信された電波が金属製物品を貫通することはなく、アンテナコイルは正常に作動するけれども、磁芯部材６の外周面に第１導体７を巻回するため、その巻線作業が比較的煩雑で量産性に欠けるとともに、アンテナコイル全体が比較的厚くなって物品から比較的大きく突出する問題点があった。本発明の目的は、金属製の物品に密着させても確実に作動するとともに、厚さを極めて薄く形成できるタグ用アンテナコイル及びそれを用いた識別タグを提供することにある。本発明の別の目的は、金属製のケースに密着させて使用するとともに、厚さを極めて薄く形成できるリーダライタ装置、リーダ装置及びライタ装置用アンテナコイルを提供することにある。本発明の更に別の目的は、量産性に適したタグ、リーダライタ装置、リーダ装置及びライタ装置用アンテナコイル及びそれを用いた識別タグを提供することにある。

【０００６】

【課題を解決するための手段】請求項１に係る発明は、図１及び図２に示すように、折り曲げ可能な単一の電気絶縁フィルム又はシート１４の一方の主面に一連の第１導体１３により１又は２以上の渦巻き部１３ａが形成され、フィルム又はシート１４が渦巻き部１３ａの中心位置で折り曲げられ、折り曲げられたフィルム又はシート１４の間に膜状、箔状、シート状又は平板状に形成された磁芯部材１２が設けられたことを特徴とするアンテナコイルである。この請求項１に記載されたアンテナコイルでは、渦巻き状に巻回された渦巻き部１３ａが二分するように電気絶縁フィルム１４が折り曲げられ、そのフィルム１４が磁芯部材１２を挟持しているので、磁芯部材１２の両主面に存在する渦巻き部１３ａに流れる電流は互いに逆方向になり、第１導体１３に生じる磁束方向は平板状に形成された磁芯部材１２の面方向に平行になる。このため、このアンテナコイル１１を物品又はケースの表面に取付けると、その磁束方向は物品又はケースの表面と平行になるため、物品又はケースが金属により形成されていても、物品又はケースに生じる渦電流は抑制され、このアンテナコイル１１は確実に作動する。

【０００７】また、渦巻き状に巻回された渦巻き部１３ａを複数設ければ、いわゆる巻き線回数を容易に増加させることができ、この巻き線回数を増加させることによりアンテナコイルの特性を向上させることができる。また、第１導体１３を電気絶縁フィルム１４又はシートに設けるので、その取り扱いが容易になり、その電気絶縁フィルム１４又はシートを折り曲げて磁芯部材１２に接着するだけの簡単な作業でアンテナコイル１１を得ることができ、磁芯部材の外周面に導線を巻回して第１導体を製作する従来の図１２に示すアンテナコイルに比較して量産性を向上させることができる。更に、磁芯部材１２を箔又はシート又は平板状に形成するので、アンテナコイル１１の厚さを極めて薄く形成することができる。このため、物品又はケースに取付けた場合のアンテナコイル１１の物品から突出量を著しく抑制することができる。

【０００８】請求項２に係る発明は、請求項１に係る発明であって、一連の第１導体１３の一方の端部と他方の端部とをフィルム又はシート１４を貫通して互いに接続する両端接続部がフィルム又はシート１４の他方の主面に第２導体１５により形成されたアンテナコイルである。この請求項２に係るアンテナコイルでは、第２導体１５をフィルム又はシート１４の他方の主面に形成しておくことにより、識別タグに必要なＩＣチップやコンデンサ、又はリーダライタ装置等における電子回路の取付け及び接続作業が容易になり、量産性に優れたアンテナコイルを得ることができる。

【０００９】請求項３に係る発明は、請求項２に係る発明であって、図８に示すように、磁芯部材１２が電気絶縁フィルム又はシート１４の主面に磁性粉を含むインク又は塗料を塗布し乾燥して形成された磁性塗膜１７であるアンテナコイルである。この請求項３に係るアンテナコイルでは、射出成形において成形が困難な０．８ｍｍ以下の厚さの磁芯部材１２を得ることができる。ここで、磁性塗膜１７は、電気絶縁フィルム又はシート１４の主面全体に形成することが好ましいが、磁性塗膜１７が可撓性にかける場合には、電気絶縁フィルム又はシート１４の折り曲げられる部分に磁性塗膜１７を塗布形成しないか、又は主面の折り曲げられる部分を境とした片側にのみその磁性塗膜１７を塗布形成することが好ましい。また、磁性塗膜１７は、磁芯部材１２を構成しうる限り、第１導体１３が形成された電気絶縁フィルム又はシート１４の一方の主面、又は第２導体１５が形成された電気絶縁フィルム又はシート１４の他方の主面のいずれに形成しても良い。

【００１０】請求項４に係る発明は、請求項１又は２に係る発明であって、図１に示すように、磁芯部材１２が、軟磁性金属，アモルファス又はフェライトからなる粉末又はフレーク及びプラスチックの複合材、軟磁性金属の板又は箔、アモルファス箔又はその積層材、或いはフェライトであるアンテナコイルである。この請求項４に係るアンテナコイルでは、磁芯部材１２が比較的薄いものになり、アンテナコイル１１の厚さ方向の大部分を占める磁芯部材１２を薄くすることにより、アンテナコイル１１全体の厚さを薄くすることができる。

【００１１】請求項５に係る発明は、請求項１ないし４

いずれかに係る発明であって、電気絶縁フィルム又はシート１４の一方の主面全体に接着された導電性箔を所定のパターンでエッチングすることにより、又は電気絶縁フィルム又はシート１４の一方の主面に導電材料を所定のパターンでスクリーン印刷若しくは蒸着することにより、第１導体１３が電気絶縁フィルム又はシート１４の一方の主面に形成されたアンテナコイルである。この請求項５に係るアンテナコイルでは、第１導体１３を電気絶縁フィルム又はシート１４に形成することが比較的容易になり、アンテナコイルの生産性を更に向上させることができる。

【００１２】請求項６に係る発明は、請求項１ないし請求項３いずれか記載のアンテナコイル１１と、アンテナコイル１１のフィルム又はシート１４に設けられたＩＣチップ１６又はコンデンサとを備え、第１導体１３の両端がＩＣチップ１６又はコンデンサに接続された識別タグである。この請求項６に係る識別タグでは、極めて薄く形成されたアンテナコイル１１のフィルム又はシート１４にＩＣチップ１６又はコンデンサを設けるので、比較的容易に識別タグを生産することができ、物品に取付けた場合のアンテナコイル１１の物品から突出量を著しく抑制することができる。

【００１３】請求項７に係る発明は、請求項１ないし請求項３いずれか記載のアンテナコイル１１と、そのアンテナコイル１１に接続された電子回路とを備えたリーダライタ装置である。請求項８に係る発明は、請求項１ないし請求項３いずれか記載のアンテナコイル１１と、アンテナコイル１１に接続された電子回路とを備えたリーダ装置である。請求項９に係る発明は、請求項１ないし請求項３いずれか記載のアンテナコイル１１と、アンテナコイル１１に接続された電子回路とを備えたライタ装置である。この請求項７ないし請求項９に係るリーダライタ装置、リーダ装置又はライタ装置では、請求項１ないし３いずれかに係るアンテナコイルを用いることにより、金属製のケースを持つことができ、またこのアンテナコイルはきわめて薄いのでケースからの突出量が少なくすることができる。この結果、全体的な厚さが極めて薄く量産性に適した強靭で小型のリーダライタ装置、リーダ装置又はライタ装置を得ることができる。

【００１４】

【発明の実施の形態】次に本発明の第１の実施の形態を図面に基づいて説明する。図１に示すように、本発明のアンテナコイル１１は、膜状、箔状、シート状又は平板状に形成された磁芯部材１２と、一連の第１導体１３により１又は２以上の渦巻き部１３ａが一方の主面に形成された単一の電気絶縁フィルム又はシート１４とを備える。磁芯部材１２は、軟磁性金属の板又は箔により形成されるか、或いは、軟磁性金属，アモルファス又はフェライトからなる粉末又はフレークとプラスチックとの複合材により長方形状に形成される。また、磁芯部材１２は、Ｆｅ系アモルファス合金（アライドケミカル社製のＭＥＴＧＬＡＳ　２６０５Ｓ－２）やＣｏ系アモルファス合金（アライドケミカル社製のＭＥＴＧＬＡＳ　２７１４Ａ）等のアモルファス箔又はその積層材により形成されたものであってもよく、長方形状に形成されたフェライトであっても良い。

【００１５】複合材におけるプラスチックとしては加工性の良い熱可塑性のプラスチックを用いたり、或いは耐熱性の良い熱硬化性のプラスチックを用いたりすることができる。また上記軟磁性金属の粉末としては、カーボニル鉄粉末，鉄－パーマロイ等のアトマイズ粉末，還元鉄粉末等が用いられる。一方、軟磁性金属のフレークとしては、上記粉末をボールミル等で微細化して粉末を成形した後に、この粉末を機械的に扁平化して得られたフレークや、鉄系又はコバルト系アモルファス合金の溶湯粒を水冷銅に衝突させて得られたフレークが用いられる。また磁芯部材１２が複合材により形成される場合、その複合材を射出成形又は圧縮成形することにより磁芯部材１２を形成することができる。このように形成された磁芯部材１２は脆弱なフェライトにより形成された磁芯部材と比較して、強靭であるため薄くしても割れ難いものになる。また軟磁性金属，アモルファス又はフェライトからなる粉末又はフレークがプラスチックに分散されて、プラスチックにより相互に絶縁されているため、全体としては導電性を有せず、高周波の電波を受けても渦電流は発生しない磁芯部材１２が得られる。

【００１６】ここで、本発明のアンテナコイル１１は、平板状に形成された磁芯部材１２と、第１導体１３を有する電気絶縁フィルム又はシート１４とによりその厚さが定められる。このため、極力薄いアンテナコイル１１を得るために、その厚さ方向の大部分を占めることになる磁芯部材１２は極力薄く形成されることが望ましい。具体的に磁芯部材１２はその厚さが０．１～１ｍｍであることが好ましい。

【００１７】図２に示すように、第１導体１３は 折り曲げ可能な単一の電気絶縁フィルム１４又はシートの一方の主面に形成される。電気絶縁フィルム１４又はシートとしてはポリエチレンテレフタレート（ＰＥＴ）又はポリイミドからなる電気絶縁性のフィルム１４又はシートが用いられ、後に折り曲げられて磁芯部材１２を挟むことからこの電気絶縁フィルム１４又はシートは磁芯部材１２を２枚並べた大きさの長方形状に形成される。第１導体１３の形成は、電気絶縁フィルム若しくはシート１４の一方の主面に接着された導電性箔を所定のパターンでエッチングすることにより、又は電気絶縁フィルム若しくはシート１４の一方の主面に導電材料を所定のパターンでスクリーン印刷若しくは蒸着することにより形成することができる。また、この実施の形態におけるタグ用アンテナコイル１１は、一連の第１導体１３の一方の端部と他方の端部とをフィルム又はシート１４を貫通

して互いに接続する両端接続部がそのフィルム又はシート１４の他方の主面に第２導体１５により形成される。

【００１８】エッチングにより第１及び第２導体１３，１５をフィルム１４に形成する手順を説明すると、先ず、このフィルム１４の両主面に銅箔を貼り合わせたものを用意する。この銅箔に耐エッチング塗料をシルクスクリーン法により印刷する。フィルム１４の一方の主面における耐エッチング塗料の印刷は、中心から矩形又は円形の渦巻き状に塗布され、その外端に後述するＩＣチップ１６の幅に相応する間隔を開けて平行な平行線が塗布される。フィルム１４の他方の主面における耐エッチング塗料の印刷は、一方の主面に塗布された渦巻き状印刷物の内端と平行線とを直線的に結ぶ線状に塗布される。その後これらの耐エッチング塗料を乾燥させて耐エッチング塗料が塗布されていないフィルム１４の両主面における銅箔をエッチング除去し、耐エッチング塗料が塗布された銅箔部分をフィルムの一方の主面上に残存させる。その後耐エッチング塗料をその銅箔上から除去することによりそのフィルム１４の一方の主面に第１導体１３とその外端に平行な端子部１３ｂを形成し、フィルム１４の他方の主面に第２導体１５を形成する。

【００１９】ここで、フィルム１４の一方の主面における耐エッチング塗料は中心から矩形又は円形の渦巻き状に塗布されるので、フィルム１４の一方の主面に形成された第１導体１３は中心から矩形又は円形の渦巻き状に形成された渦巻き部１３ａを有することになる。その後、第１導体１３の一方の端部である渦巻き部１３ａの内端には、フィルム１４を貫通しその内端に対向する第２導体１５の一端に連通する第１貫通孔１４ａ（図３）が形成され、端子部１３ｂには、フィルム１４を貫通し第２導体１５の他端に連通する第２貫通孔１４ｂ（図３）が形成される。第１及び第２貫通孔１４ａ，１４ｂにはその後いわゆるスルホールメッキが施され、渦巻き部１３ａの内端と第２導体１５の一端、第２導体１５の他端と端子部１３ｂは電気的に接続される。このようにフィルム１４に形成された第１及び第２導体１３，１５の位置関係を図３に示す。このエッチングによると第１及び第２導体１３，１５が形成された電気絶縁フィルム１４又は電気絶縁シートを比較的安価に製造することができる。

【００２０】また、この実施の形態ではアンテナコイル１１を用いて識別タグ１０を製作する場合を示し、その識別タグ１０に必要なＩＣチップ１６がフィルム１４に設けられる。このＩＣチップ１６は、フィルム１４の一方の主面に形成された第１導体１３と端子部１３ｂとを架設するようにフィルム１４の一方の主面に搭載され、その状態で第１導体１３及び端子部１３ｂとにはんだ付けされ、コイル部１３ａの外端である第１導体１３の他方の端部にＩＣチップ１６が直接接続され、コイル部１３ａの内端である第１導体１３の一方の端部は第２導体１５を介してＩＣチップ１６に接続される。

【００２１】このように第１導体１３が設けられた電気絶縁フィルム１４は、渦巻き状に巻回された渦巻き部１３ａが二分されるように折り曲げられる。この実施の形態における電気絶縁フィルム１４の折り曲げは、第１導体１３が外側になるように、図２の一点鎖線で示す中央部分で折り曲げられる。図１に示すように折り曲げられた電気絶縁フィルム１４は磁芯部材１２を挟むようにしてその磁芯部材１２に接着される。電気絶縁フィルム１４の磁芯部材１２への接着は、磁芯部材１２及び電気絶縁フィルム１４のいずれか一方又は双方に接着剤を塗布し、その後電気絶縁フィルム１４を折り曲げて磁芯部材１２を挟むようにして磁芯部材１２に接着する。

【００２２】このように構成されたアンテナコイル１１は、その厚さが極めて薄く、第１導体１３にＩＣチップ１６を電気的に接続しているのでＲＦＩＤ技術を用いた識別タグ１０が製造され、このように製造された識別タグ１０も極めて薄いため、図４に示すように物品１８に取付けても、アンテナコイル１１が物品１８から殆ど突出することはない。また、渦巻き状に巻回された渦巻き部１３ａが二分するように電気絶縁フィルム１４が折り曲げられ、そのフィルム１４が磁芯部材１２を挟持しているので、磁芯部材１２の両主面に存在する渦巻き部１３ａに流れる電流は互いに逆方向になり、第１導体１３の磁束方向は平板状に形成された磁芯部材１２の面方向に平行になる。このため、このアンテナコイル１１を物品の表面に取付けると、その磁束方向は図４の矢印で示すような物品１８の表面と平行になるため、物品１８が金属により形成されていても、物品１８に生じる渦電流は抑制されてアンテナコイル１１の共振周波数は上記金属製の物品の影響を受けず、このアンテナコイル１１は確実に作動する。但し、物品１８の表面が金属により形成されている場合には、渦巻き部１３ａがその金属と接触して導通することを防止するため、図５に示すようにその渦巻き部１３ａと物品１８の間に絶縁フィルム１９を介装させる必要がある。更にアンテナコイルの物品に接する部分にアンテナコイルよりやや大きいアルミニウム板等の導電板を配置し、その状態で所望のインダクタンスとなるようにコイルの面積及び巻数を選定すれば、物品の影響は少なくなる。

【００２３】また、このアンテナコイル１１では第１導体１３を電気絶縁フィルム１４又はシートに設けるので、その取り扱いが容易になり、その電気絶縁フィルム１４又はシートを折り曲げて磁芯部材１２に接着するだけの簡単な作業でアンテナコイル１１を得ることができ、磁芯部材の外周面に導線を巻回して第１導体を製作する従来のアンテナコイルに比較して量産性を向上させることができる。また、タグ用アンテナコイル１１が電気絶縁フィルム１４又はシートを備えるので、タグとして使用する場合に必要なＩＣチップ１６をこの電気絶縁

フィルム１４又はシートに接着することが可能になり、この実施の形態のようにＩＣチップ１６を予め接着しておくことにより、折り曲げた電気絶縁フィルム１４又はシートを磁芯部材１２に接着した段階で所望のタグを得ることが可能になり、更にその量産性を向上させることができる。

【００２４】なお、上述した実施の形態では、軟磁性金属，複合材、軟磁性金属の板又は箔、アモルファス箔又はその積層材、或いはフェライトからなる磁芯部材１２を説明したが、磁芯部材１２は図示しないが絶縁性樹脂フィルム又はシートと、この絶縁性樹脂フィルム又はシートの表面に形成された磁性塗膜とを備えるものであっても良い。この磁芯部材では、絶縁性樹脂フィルム又はシートの表面に磁性材料からなる粉末又はフレークを含む塗料を塗布乾燥することにより作られ、射出成形において成形が困難な０．８ｍｍ以下の厚さの磁芯部材１２を得ることができ、更に薄いアンテナコイル１１を得ることができる。

【００２５】また、上述した実施の形態では、電気絶縁フィルム１４を第１導体１３が外側になるように折り曲げたが、図７に示すように第１導体１３が内側になるように電気絶縁フィルム１４を折り曲げても良い。但し、第１導体１３が内側になる場合であって磁芯部材１２が導電性である場合には、磁芯部材１２の表面を絶縁材で覆った後に挟まれる。更に、上述した実施の形態では、軟磁性金属，複合材、軟磁性金属の板又は箔、アモルファス箔又はその積層材、或いはフェライトからなる磁芯部材１２を説明したが、磁芯部材１２を磁性塗膜により形成しても良い。この場合図６に示すように、第１導体１３を形成した電気絶縁フィルム又はシート１４に磁性塗膜１７を直接塗布形成すれば、その電気絶縁フィルム又はシート１４を折り曲げるだけの単純な作業により図７に示すアンテナコイルを比較的容易に得ることができる。

【００２６】次に、図８～図１０に本発明の第２の実施の形態を示す。図面中上述した実施の形態と同一符号は同一部品を示し、繰り返しての説明を省略する。図１０に示すように、この実施の形態における第１導体１３は渦巻き状に巻回された複数の渦巻き部１３ａ，１３ａを有し、この複数の渦巻き部１３ａ，１３ａは所定の間隔を開けて単一の電気絶縁フィルム１４に設けられる。図では２つの渦巻き状に巻回された渦巻き部１３ａ，１３ａが電気絶縁フィルム１４に設けられる例を示し、２つの渦巻き部１３ａ，１３ａを有する第１導体１３は、電気絶縁フィルム１４の表面にＣｕ，Ａｌ，Ｚｎ等の導電材料を所定のパターンでスクリーン印刷又は蒸着することにより形成される。印刷又は蒸着して第１導体１３を電気絶縁フィルム１４の表面に形成することにより、比較的多くの生産を比較的安価に行うことが可能になる。電気絶縁フィルム１４の裏面には第２導体１５（図１０）がスクリーン印刷又は蒸着することにより形成され、ＩＣチップ１６が電気絶縁フィルム１４に接着された状態で２つの連続した渦巻き部１３ａ、１３ａを有する第１導体１３に第２導体１５を介して電気的に接続される。

【００２７】図９に示すように、電気絶縁フィルム１４の裏面には、磁性材料からなる粉末又はフレークを含む塗料が塗布乾燥され、その絶縁性樹脂フィルム１４の裏面に磁性塗膜１７が形成される。ここで塗料に含ませる磁性材料の粉末としては、カーボニル鉄粉末，鉄－パーマロイ等のアトマイズ粉末，還元鉄粉末等が用いられる。一方、磁性材料のフレークとしては、上記粉末をボールミル等で微細化して粉末を成形した後に、この粉末を機械的に扁平化して得られたフレークや、鉄系又はコバルト系アモルファス合金の溶湯粒を水冷銅に衝突させて得られたフレークが用いられる。

【００２８】ここで磁性塗膜１７を形成する際の絶縁性樹脂フィルム１４又はシートの厚さは１０～１００μｍであることが好ましく、更に好ましくは２０～４０μｍである。また形成された磁性塗膜１７の厚さは１０～８００μｍが好ましく、更に好ましくは３０～３００μｍである。なお、塗料を一度塗布しただけでは所定の厚さが得られない場合には、繰り返し同一の塗料を塗布乾燥することにより所望の厚さの塗膜１７を得ることができる。この磁性塗膜１７は後に磁芯部材１２としての役割を果たし、射出成形において成形が困難な０．８ｍｍ以下の厚さの磁芯部材１２を比較的安価に得ることが可能になる。また、塗料を塗布乾燥させることにより磁性塗膜１７を形成するので、その塗料に磁性材料からなるフレークを含ませた場合には、そのフレークを絶縁性樹脂フィルム１４又はシートの表面に平行に配置することにより、磁芯部材１２の特性を向上させることも可能になる。

【００２９】その後、図９の矢印で示すように電気絶縁フィルム１４は複数の渦巻き部１３ａ，１３ａの中心でそれぞれ二分されるように折り曲げられるが、その際磁性塗膜１７が内側になるように折り曲げられる。この電気絶縁フィルム１４は、複数の第１導体１３，１３の連続する方向に直交する方向でそれぞれ同一方向に折り曲げられて接着される。図８に示すように、この実施の形態では２回電気絶縁フィルム１４を折り曲げることにより磁性塗膜１７が電気絶縁フィルム１４によって包み込まれ、磁性塗膜からなる磁芯部材１２を有するアンテナコイルが得られる。

【００３０】このように構成されたアンテナコイル１１は、磁性塗膜からなる磁芯部材を有するので、その厚さを更に薄くすることができ、複数の第１導体１３，１３を設けたのでアンテナコイルの特性を更に向上させることができる。このため、磁束方向が物品表面と平行であって、物品から殆ど突出することのないアンテナコイル

１１を得ることができる。また、磁芯部材１２が予め電気絶縁フィルム１４又はシートに塗布形成された磁性塗膜１７からなるので、その取り扱いが更に容易になり、電気絶縁フィルム１４又はシートを折り曲げて磁芯部材１２に接着するだけの極めて簡単な作業でアンテナコイル１１を得ることができ、アンテナコイル１１の量産性を更に向上させることができる。

【００３１】なお、上述した第２の実施の形態では、第１導体１３が渦巻き状に巻回された２つの渦巻き部１３ａ，１３ａを有し、電気絶縁フィルム１４を２回折り曲げる場合を説明したが、第１導体１３は渦巻き状に巻回された渦巻き部１３ａを３つ、４つ、５つ、６つ又は７つ以上有しても良い。渦巻き状に巻回された渦巻き部の数を増加させると、いわゆる巻き線回数が増加することになり、この巻き線回数を増加させることによりアンテナコイルの特性を向上させることができる。但し、それら複数の渦巻き部はそれぞれ二分される必要があるため、電気絶縁フィルム又はシートはその渦巻き部の数に相応する数だけ折り曲げる必要がある。第１導体１３が４つの渦巻き部１３ａ，１３ａを有する場合を図１１に示す。この図１１では電気絶縁フィルム又はシート１４がその渦巻き部の数に相応する４回折り曲げられ、４つの渦巻き部１３ａがそれぞれ二分されて磁芯部材１２の両主面に存在する限り第１導体１３の磁束方向は磁芯部材１２の面方向に平行になり、渦巻き部１３ａの数に比例してアンテナコイルの特性を向上させることができる。

【００３２】また、上述した第１及び第２実施の形態ではアンテナコイル１１を用いて識別タグ１０を製作する場合をそれぞれ示したが、本発明のアンテナコイルをリーダライタ装置、リーダ装置又はライタ装置に用いても良い。この場合、アンテナコイル１１の厚さは極めて薄いので、リーダライタ装置、リーダ装置又はライタ装置のケースにこのアンテナコイル１１を取付けても、アンテナコイル１１がケースから殆ど突出することはない。また、磁束方向は平板状に形成された磁芯部材１２の面方向に平行になるため、その磁束方向はケースの表面と平行になり、ケースが金属により形成されていても、ケースに生じる渦電流は抑制されてアンテナコイル１１の共振周波数は上記金属製のケースの影響を受けず、このアンテナコイル１１は確実に作動する。

【００３３】

【実施例】次に本発明の実施例を比較例とともに詳しく説明する。

＜比較例１＞図２に示すように単一の電気絶縁フィルムに第１導体１３を設けた。電気絶縁フィルムとしては、厚さ５０μｍのポリイミドフィルムを用いた。第１導体１３は、このポリイミドフィルムに積層接着された厚さ３５μｍの銅箔をエッチングすることにより第１導体１３を形成し、この第１導体１３は外形が１６ｍｍ×５０ｍｍであり、幅が０．８ｍｍの渦巻き部を４回巻回させて形成した。この電気絶縁フィルムに設けられた第１導体１３のみからなるアンテナコイルを比較例１とした。

【００３４】＜実施例１＞比較例１と同一の電気絶縁フィルムに比較例１と同一の手順により比較例１と同一の第１導体１３を設けた。また、別に厚さが５０μｍであって外形が８ｍｍ×５０ｍｍのポリイミドフィルムを２枚準備し、磁性フレークを含むインクをこれらのポリイミドフィルムの片面にそれぞれ塗布乾燥させ、厚さ１３０μｍの磁性塗膜をそれらの片面にそれぞれ形成した。そして磁性塗膜が形成された２枚のポリイミドフィルムを重ね合わせた。一方、第１導体が二分されるように電気絶縁フィルムを折り曲げ、その間に磁性塗膜が形成された２枚のポリイミドフィルムを挿入して図１に示すアンテナコイルを得た。このようにして電気絶縁フィルムで磁性塗膜からなる磁芯部材を挟んでアンテナコイルを実施例１とした。なお、厚さ０．１ｍｍ、幅１０ｍｍ、長さ６０ｍｍのアルミニウム板を物品に接する部分に配置した。

【００３５】＜実施例２＞厚さが３５μｍであって外形が４９ｍｍ×５０ｍｍであるポリイミドフィルムからなる電気絶縁フィルム１４を準備し、図１２に示すように、このポリイミドフィルムに積層接着された厚さ３５μｍの銅箔をエッチングすることにより長方形状の２つの渦巻き部１３ａ，１３ａを有する第１導体１３を形成した。この２つの渦巻き部１３ａ，１３ａからなる第１導体１３は外形が４８ｍｍ×４８ｍｍであり、長手方向における導体幅が３ｍｍであって、それに直交する方向における導体幅が２ｍｍになるようにし、２つの渦巻き部１３ａ，１３ａは導体間の間隔が１ｍｍになるようにそれぞれ２回巻回させて形成した。

【００３６】また、別に厚さが５０μｍであって外形が２４ｍｍ×５０ｍｍのポリイミドフィルムを４枚準備し、磁性フレークを含むインクをこれらのポリイミドフィルムの片面にそれぞれ塗布乾燥させ、厚さ１６０μｍの磁性塗膜をそれらの片面にそれぞれ形成した。そして磁性塗膜が形成された４枚のポリイミドフィルムを重ね合わせて磁芯部材１２とした。一方、図１２の一点鎖線で示すように、電気絶縁フィルム１４は複数の渦巻き部１３ａ，１３ａの中心でそれぞれ二分されるように折り曲げ、図１３に示すようにその電気絶縁フィルム１４で磁芯部材１２を包むことによりアンテナコイルを得た。このアンテナコイルを実施例２とした。なお、厚さ５０μｍのポリイミドフィルムを物品に接する部分に配置した。

【００３７】＜比較試験＞物品として、１００ｍｍ×１００ｍｍであって厚さが０．１６ｍｍのアクリル板と、そのアクリル板と同形同大のアルミニウム板及び軟鋼板をそれぞれ準備した。これらのアクリル板、アルミニウム板及び軟鋼板の表面に上述した比較例１、実施例１及

び実施例2におけるアンテナコイルをそれぞれ配置した。この場合の所定の周波数に対する第1導体のL値並びにQ値をそれぞれ測定した。また、比較例1、実施例1及び実施例2のアンテナコイルにそれぞれICチップを接続して13．56MHzで作動するタグを得た。このタグを上述したアクリル板、アルミニウム板及び軟鋼板の表面にそれぞれ配置した場合の動作の有無を確認した。これらの結果を表1にそれぞれ示す。

【0038】

【表1】

	物品	アクリル板		アルミ板		軟鋼板	
	所定の周波数（MHz）	L（μH）	Q	L（μH）	Q	L（μH）	Q
比較例1	1	1.257	7.1	0.538	2.5	1.002	2.0
	5	1.222	26.1	0.448	8.9	0.660	3.3
	10	1.231	42.7	0.440	14.5	0.583	4.1
	12	1.240	48.0	0.440	16.5	0.568	4.3
	13.56	1.245	51.9	0.440	17.9	0.561	4.5
	15	1.256	53.9	0.440	18.9	0.554	4.6
	20	1.293	61.0	0.443	22.2	0.541	5.1
	動作の有無	作動		非作動		非作動	
実施例1	1	0.958	4.7	0.917	4.5	0.969	4.4
	5	0.906	16.6	0.862	15.4	0.896	13.3
	10	0.909	25.0	0.866	23.0	0.897	19.1
	12	0.915	25.7	0.875	24.4	0.904	20.2
	13.56	0.921	27.0	0.882	24.8	0.911	20.5
	15	0.927	26.1	0.890	24.0	0.919	19.9
	20	0.951	21.0	0.923	19.4	0.951	16.7
	動作の有無	作動		作動		作動	
実施例2	1	0.875	8.2	0.543	6.5	0.573	6.4
	5	0.804	28.9	0.510	22.4	0.528	19.3
	10	0.806	43.5	0.512	33.4	0.528	27.7
	12	0.811	44.8	0.517	36.4	0.532	29.3
	13.56	0.816	47.0	0.520	36.0	0.536	29.8
	15	0.821	45.5	0.526	34.8	0.541	28.9
	20	0.842	36.6	0.545	28.2	0.560	24.4
	動作の有無	作動		作動		作動	

【0039】表1から明らかなように、実施例1及び実施例2ではアクリル板、アルミニウム板及び軟鋼板上のいずれでもL値はほとんど変らず、アルミニウム板及び軟鋼板上の場合もアクリル板の場合に比較してQ値の低下は少ない。しかし比較例1ではアクリル板上に比較しアルミニウム板上ではL値が著しく変化する。また軟鋼板上の場合はQ値が著しく低下する。これは実施例1ではコイルから発生する磁束の方向が板の面に平行で導電板により遮蔽されているので、板の表面には達しないものの、比較例では磁束の方向が板の面に垂直であって、磁束の大部分は板に到達することによる。また、実施例1及び実施例2のアンテナコイルにICチップを接続したタグは、アクリル板、アルミニウム板及び軟鋼板のいずれの表面に配置しても動作するのに対して、比較例1のアンテナコイルにICチップを接続したタグは、アクリル板の表面に配置した場合にのみ動作し、アルミニウム板及び軟鋼板の表面に配置した場合には動作しなかった。これはアルミニウム板の場合はL値が変化し、共振周波数が変化したことと、エネルギーが鉄板に吸収され損失となったためと考えられる。

【0040】

【発明の効果】以上述べたように、本発明によれば、単一の電気絶縁フィルム又はシートに第1導体を設け、渦巻き状に巻回された渦巻き部の中心で電気絶縁フィルム又はシートを折り曲げ、折り曲げられた電気絶縁フィルム又はシートにより磁芯部材を挟んでその電気絶縁フィルム又はシートを磁芯部材に接着するので、アンテナコイルの厚さを極めて薄く形成することができる。また、このアンテナコイルを物品又はケースの表面に取付けると、その磁束方向は物品表面と平行になるため、物品又はケースが金属により形成されていても、物品又はケースに生じる渦電流は抑制されてアンテナコイルの共振周波数は上記金属製の物品又はケースの影響を受けず、確実に作動するアンテナコイルを得ることができ、それを用いた識別タグの物品からの突出量をを抑制することができる。

【0041】また、複数の渦巻き状に巻回された渦巻き部を所定の間隔を開けて単一の電気絶縁フィルム又はシートに設け、それらの渦巻き部の中心で電気絶縁フィルム又はシートを複数回同一方向に折り曲げ、複数回折り曲げられた電気絶縁フィルム又はシートで磁芯部材を包み込んで接着すれば、いわゆる巻き線回数を容易に増加させることができ、この巻き線回数を増加させることにより特性を更に向上させたアンテナコイルを得ることができる。

【0042】更に、第1導体をエッチングにより又はス

クリーン印刷若しくは蒸着することにより形成すれば、電気絶縁フィルム又はシートへの第１導体の形成が比較的容易になる。一方、磁芯部材が、軟磁性金属，アモルファス又はフェライトからなる粉末又はフレーク及びプラスチックの複合材、軟磁性金属の板又は箔、アモルファス箔又はその積層材、或いはフェライトであれば、磁芯部材が比較的薄いものになり、アンテナコイル全体の厚さを薄くすることができる。特に電気絶縁フィルム又はシートに形成された磁性塗膜を磁芯部材とすることにより、磁芯部材を更に薄くすることができ、射出成形において成形が困難な０．８ｍｍ以下の厚さの磁芯部材により更に薄いアンテナコイルを得ることが可能になる。

【図面の簡単な説明】

【図１】本発明第１実施形態のアンテナコイルを有する識別タグの斜視図。

【図２】電気絶縁フィルム又はシートに形成された第１導体を示す平面図。

【図３】そのフィルム又はシートと第１及び第２導体の関係を示す分解斜視図。

【図４】その識別タグが物品に取付けられた状態を示す図１のＡ－Ａ線断面図。

【図５】渦巻き部と物品の間に絶縁フィルムが介装された図４に対応する断面図。

【図６】第１導体上に磁性塗膜が形成された電気絶縁フィルム又はシートを示す縦断面図。

【図７】その電気絶縁フィルム又はシートが折り曲げられて得られたアンテナコイルを示す縦断面図。

【図８】本発明第２実施形態のアンテナコイルを示す図４に対応する断面図。

【図９】その電気絶縁フィルム又はシートに磁性塗膜が形成された状態を示す図１０のＢ－Ｂ線断面図。

【図１０】そのアンテナコイルにおける第１導体を示す図２に対応する平面図。

【図１１】第１導体が４つの渦巻き部を有するアンテナコイルを示す図８に対応する断面図。

【図１２】第２実施例における２つの渦巻き部からなる第１導体を示す平面図。

【図１３】その第１導体を有するアンテナコイルの斜視図。

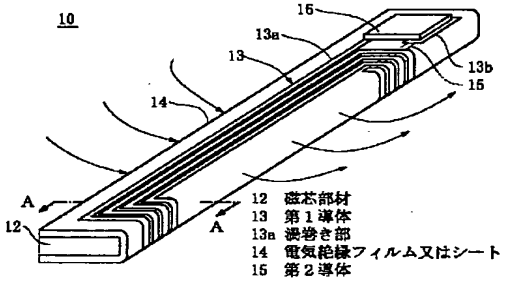
【図１４】磁芯部材に螺旋状に巻回された第１導体を有する従来のアンテナコイルを示す斜視図。

【図１５】渦巻き状の渦巻き部からなる従来のアンテナコイルを示す斜視図。

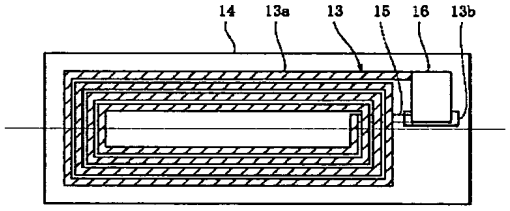
【符号の説明】

１１　タグ用アンテナコイル
１２　磁芯部材
１３　第１導体
１３ａ　渦巻き部
１４　電気絶縁フィルム又はシート
１５　第２導体
１７　磁性塗膜

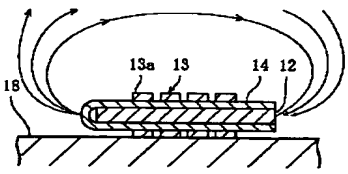
【図１】



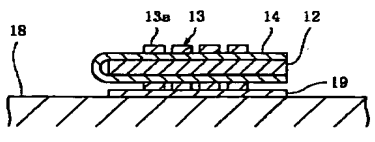
【図２】



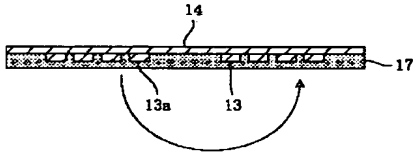
【図４】



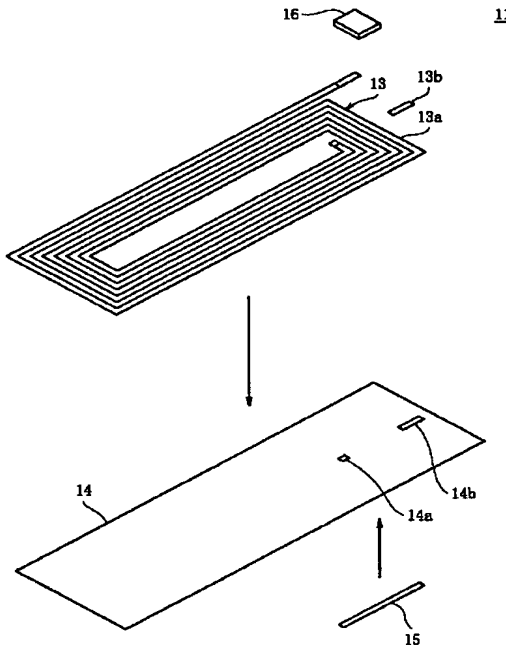
【図５】



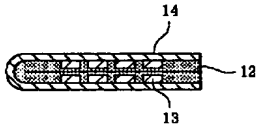
【図６】



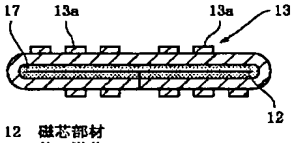
【図3】



【図7】

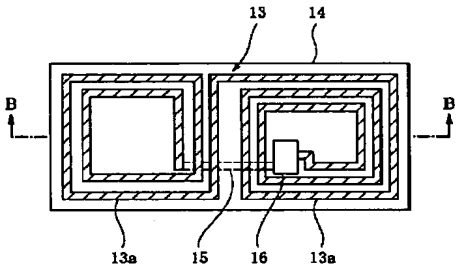


【図8】

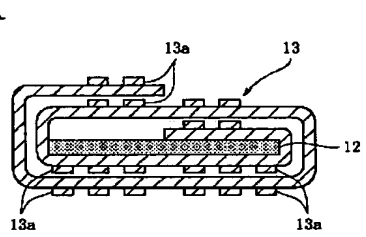


12 磁芯部材
13 第1導体
13a 渦巻き部
14 電気絶縁フィルム又はシート
17 磁性薄膜

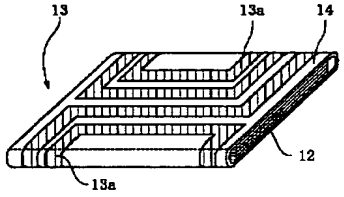
【図10】



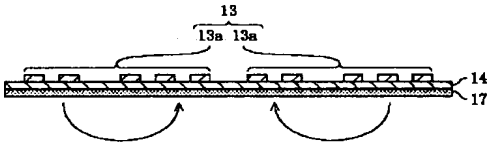
【図11】



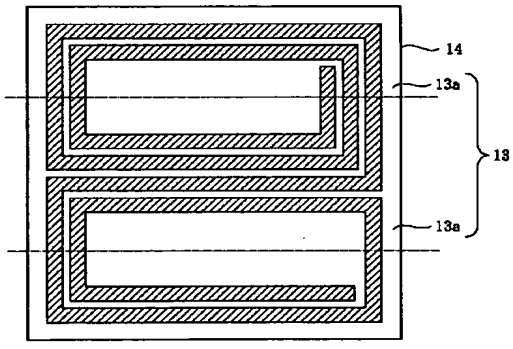
【図13】



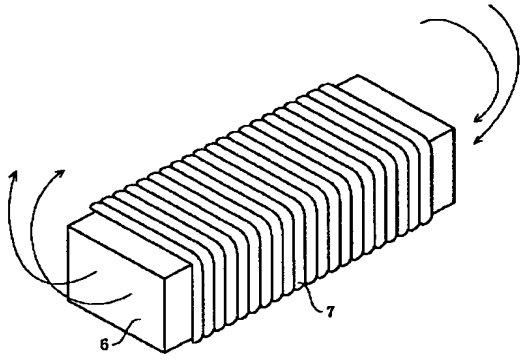
【図9】



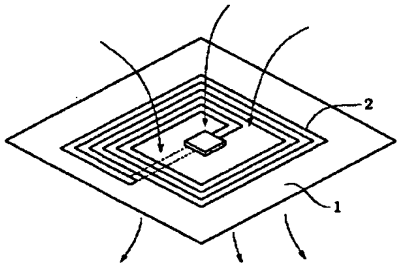
【図12】



【図14】



【図１５】



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(72)発明者　土田　隆
東京都文京区小石川１丁目12番14号　三菱マテリアル株式会社ＲＦ－ＩＤ事業センター内

(72)発明者　八幡　誠朗
東京都文京区小石川１丁目12番14号　三菱マテリアル株式会社ＲＦ－ＩＤ事業センター内

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